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For: STEERABLE DELIVERY SYSTEM

1 1. A steerable delivery system comprising:
2 a steerable section rigid along its longitudinal axis and flexible in at least one
3 direction off-axis;
4 a follower section rigid along its longitudinal axis and flexible in at least the same
5 direction as the steerable section, both the steerable section and the follower section advanceable
6 in the direction of the longitudinal axis;
7 a pivot member disposed between a proximal end of the steerable section and a
8 distal end of the follower section; and
9 a steering mechanism on the proximal end of the follower section for actively
10 flexing the steerable section at the pivot member, and steering the steerable section in said one
11 direction, the follower section flexing to follow the steerable section.

1 2. The system of claim 1 in which the distal end of the steerable section includes an
2 end effector coupled thereto.

1 3. The system of claim 1 in which the steerable section includes a plurality of abutting
2 links.

1 4. The system of claim 3 in which each steerable section link includes a plurality of
2 cables therethrough terminating at a distal end of the steerable section for steering the steerable

3 section.

1 5. The system of claim 3 in which each steerable section link includes at least one
2 orifice for receiving a conduit, a transmission line, or a shaft therethrough.

1 6. The system of claim 3 in which each steerable section link includes upper inner and
2 outer opposing faces, lower inner and outer opposing faces, and a central section interconnecting
3 the upper opposing faces with the lower opposing faces.

1 7. The system of claim 6 in which the inner faces of each steerable section link abut
2 the outer faces of each adjacent steerable section link.

1 8. The system of claim 6 in which each upper and lower face of each steerable section
2 link includes at least one steering cable extending slideably therethrough and terminating on one
3 end at a distal end of the steerable section, passing slideably through the pivot member and the
4 follower section, and terminating at an opposite end at the steering mechanism.

1 9. The system of claim 1 in which the follower section includes a plurality of abutting
2 links.

1 10. The system of claim 9 in which each follower section link includes a plurality of
2 steering cables passing therethrough terminating at a distal end of the steerable section for steering
3 the steerable section.

1 11. The system of claim 10 in which each follower section link also includes at least
2 one tie cable extending therethrough terminating at one end at the pivot member and terminating at
3 the other end at the steering mechanism.

1 12. The system of claim 9 in which each follower section link includes at least one
2 orifice for receiving a conduit, a transmission line, or a shaft therethrough.

1 13. The system of claim 9 in which each follower section link includes upper inner and
2 outer opposing faces, lower inner and outer opposing faces, and a central section interconnecting
3 the upper opposing faces with the lower opposing faces.

1 14. The system of claim 13 in which the inner faces of each follower section link abut
2 the outer faces of each adjacent follower section link.

1 15. The system of claim 13 in which the upper and lower faces of each follower section
2 link include at least one steering cable extending slideably therethrough and terminating on one
3 end at a distal end of the steerable section, passing slideably through the pivot member, and
4 terminating at an opposite end at the steering mechanism.

1 16. The system of claim 15 in which the upper and lower faces of each follower section
2 link further includes at least one tie cable extending therethrough terminating on one end at the
3 pivot member and terminating on the other end at the steering mechanism.

1 17. The system of claim 3 in which each steerable section link includes upper and
2 lower faces each having opposing tapered sections.

1 18. The system of claim 9 in which each follower section link includes upper and
2 lower faces each having opposing tapered sections.

1 19. The system of claim 17 wherein the opposing tapered sections meet at a point.

1 20. The system of claim 18 wherein the opposing tapered sections meet at a point.

1 21. The system of claim 1 in which the steerable section and the follower section each
2 include a plurality of abutting links, wherein all of the links include at least one steering cable
3 passing slideably therethrough, the steering cable fixed on one end at a distal end of the steerable
4 section and fixed on the opposite end at the steering mechanism, and further wherein at least the
5 links of the follower section include at least one tie cable passing therethrough, the tie cable fixed
6 on one end at the pivot member and fixed on an opposite end at the steering mechanism.

1 22. The system of claim 1 in which the steerable section includes a plurality of abutting
2 links wherein the links of the steerable section include at least one steering cable passing slideably
3 therethrough, the steering cable fixed on one end at a distal end of the steerable section, passing
4 through the pivot member and the follower section, and fixed on an opposite end at the steering
5 mechanism, the follower section further including at least one tie cable passing therethrough, the

6 tie cable fixed on one end at the pivot member and fixed on an opposite end at the steering
7 mechanism.

1 23. The system of claim 3 in which each steerable section link includes at least one ball
2 and at least one socket and wherein the ball of one link is pivotably received in the socket of an
3 adjacent link.

1 24. The system of claim 23 in which each steerable section link includes two opposing
2 outwardly extending balls and two opposing inwardly extending sockets.

1 25. The system of claim 24 in which the sockets are offset from the balls.

1 26. The system of claim 24 in which the sockets are offset 90 degrees from the balls.

1 27. The system of claim 23 in which each steerable section link includes a tube shaped
2 wall having outwardly extending balls on one end thereof and inwardly extending sockets in an
3 opposite end thereof.

1 28. The system of claim 9 in which each follower section link includes at least one ball
2 and at least one socket and wherein the ball of one link is pivotably received in the socket of an
3 adjacent link.

1 29. The system of claim 28 in which each follower section link includes two opposing

2 outwardly extending balls and two opposing inwardly extending sockets.

1 30. The system of claim 29 in which the sockets are offset from the balls.

1 31. The system of claim 30 in which the sockets are offset 90 degrees from the balls.

1 32. The system of claim 28 in which each follower section link includes a tube shaped
2 wall having outwardly extending balls on one end thereof and inwardly extending sockets in an
3 opposite end thereof.

1 33. The system of claim 2 in which end effector includes an optical device.

1 34. The system of claim 2 in which the end effector includes a nozzle.

1 35. The system of claim 2 in which the end effector includes a tool.

1 36. The system of claim 1 in which the length of the steerable section is much less than
2 the length of the follower section.

1 37. The system of claim 1 in which the pivot member is connected to a distal end of the
2 follower section.

38. A steerable delivery system comprising:

- a steerable section having a distal end effector and including a plurality of links, each link including an orifice therethrough for receiving a conduit, transmission line, or a shaft connected to the end effector;
- a follower section rigid along its longitudinal axis and flexible in an least one direction off-axis;
- a pivot mechanism disposed between a proximal end of the steerable section and a distal end of the follower section, the steerable section pivotable with respect to the pivot mechanism;
- a steering mechanism on a proximal end of the follower section; and
- at least one steering cable extending from the steering mechanism through the follower section, the pivot mechanism, and the links of the steerable section and terminating at the distal end of the steerable section.

39. The system of claim 38 wherein the follower section also includes a plurality of links.

40. The system of claim 39 further including a tie cable extending from the steering mechanism, through the links of the follower section, and terminating at the pivot mechanism.

41. The system of claim 38 in which each steerable section link includes upper inner and outer opposing faces, lower inner and outer opposing faces, and a central section interconnecting the upper opposing faces with the lower opposing faces.

1 49. The system of claim 46 in which each follower section link includes upper inner
2 and outer opposing faces, lower inner and outer opposing faces, and a central section
3 interconnecting the upper opposing faces with the lower opposing faces.

1 50. The system of claim 49 in which the inner opposing faces of each follower section
2 link abut the outer opposing faces of each adjacent follower section link.

1 51. The system of claim 49 in which the steering cable extends through an upper or
2 lower face of the follower section links.

1 52. The system of claim 49 in which an upper or lower face of each follower section
2 link includes at least one tie cable extending therethrough terminating on one end at the pivot
3 member and fixed on the other end at the steering mechanism.

1 53. The system of claim 38 in which each steerable section link includes upper and
2 lower surfaces each having opposing tapered sections.

1 54. The system of claim 45 in which each follower section link includes upper and
2 lower surfaces each having opposing tapered sections.

1 55. The system of claim 38 in which the follower section includes a plurality of
2 abutting links, and wherein all of the links of the steerable section and the follower section include
3 the at least one steering cable passing slideably therethrough, and further wherein the follower

4 section links also include at least one tie cable passing therethrough, the tie cable terminating at
5 one end at the pivot member and fixed on an opposite end at the steering mechanism.

1 56. The system of claim 38 in which each steerable section link includes at least one
2 ball and at least one socket wherein the ball of one steerable section link is pivotably received in
3 the socket of an adjacent steerable section link.

1 57. The system of claim 56 in which each steerable section link includes two opposing
2 outwardly extending balls and two opposing inwardly extending sockets.

1 58. The system of claim 57 in which the sockets are offset from the balls.

1 59. The system of claim 58 in which the sockets are offset 90 degrees from the balls.

1 60. The system of claim 56 in which each steerable section link includes a tube shaped
2 wall having outwardly extending balls on one end thereof and inwardly extending sockets in an
3 opposite end thereof.

1 61. The system of claim 39 in which each follower section link includes at least one
2 ball and at least one socket and wherein the ball of one follower section link is pivotably received
3 in the socket of an adjacent follower section link.

1 62. The system of claim 61 in which each follower section link includes to opposing

2 outwardly extending balls and two opposing inwardly extending balls.

1 63. The system of claim 62 in which the sockets are offset from the balls.

1 64. The system of claim 63 in which the sockets are offset 90 degrees from the balls.

1 65. The system of claim 39 in which each follower section link includes a tube shaped
2 wall having outwardly extending balls on one end thereof and inwardly extending sockets in an
3 opposite end thereof.

1 66. The system of claim 38 in which said distal end effector includes an optical device.

1 67. The system of claim 38 in which the distal end effector includes a nozzle.

1 68. The system of claim 38 in which the distal end effector includes a tool.

1 69. The system of claim 38 in which the length of the steerable section is much less
2 than the length of the follower section.

1 70. The system of claim 38 in which the pivot member is connected to a distal end of
2 the follower section.

1 71. A steerable delivery system comprising:
2 a steerable section having a distal end effector and including at least one orifice
3 through the steerable section for receiving a conduit, transmission line, or a shaft;
4 a follower section including a plurality of links and configured to be rigid along its
5 longitudinal axis and flexible in an least one direction off-axis;
6 a pivot mechanism disposed between the proximal end of the steerable section and
7 the distal end of the follower section, the steerable section pivotable with respect to the pivot
8 mechanism;
9 a steering mechanism on the proximal end of the follower section; and
10 at least one steering cable extending from the steering mechanism through the links
11 of the follower section, the pivot mechanism, and the steerable section and terminating at the distal
12 end of the steerable section.

1 72. The system of claim 71 wherein the steerable section also includes a plurality of
2 links.

1 73. The system of claim 71 further including a tie cable extending from the steering
2 mechanism, through the links of the follower section, and terminating at the pivot mechanism.